

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : **09-275598**

(43)Date of publication of application : **21.10.1997**

---

(51)Int.Cl.

**H04R 9/02**

**H04R 9/02**

**H04R 9/04**

---

(21)Application number : **08-085116**

(71)Applicant : **HITACHI LTD**

(22)Date of filing : **08.04.1996**

(72)Inventor : **MORI TORU**

---

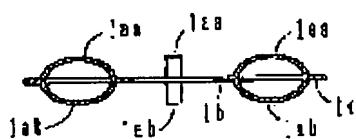
## **(54) CENTERING SPIDER FOR SPEAKER AND SPEAKER USING IT**

### **(57)Abstract:**

**PROBLEM TO BE SOLVED:** To realize the butterfly damper centering spider by which a damage of the speaker due to torsion of spokes attended with piston vibration of the speaker is prevented and a large input is applied to the speaker while a small effective mass is kept and secondary resonance is hardly caused.

**SOLUTION:** The centering spider is made up of 4 couples of spokes 1a, and rings 1b, 1c. One end of each spoke 1a is connected to the ring 1b and the other end is connected to the ring 1c. The four couples of the spokes 1a are made up of spokes 1aa, 1ab in pairs while being curved opposite to each other in the vibration direction stereoscopically. When a piston vibration is caused in the speaker, since the middle part of the spokes 1aa, 1ab is expanded/ contracted, no torsional vibration is caused in the spokes 1a and no stress is caused at the connection part of the

rings 1b, 1c adhered to a voice coil bobbin and a frame.



## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

#### [0001]

[Field of the Invention] This invention relates to the centering spider which holds the voice coil connected [ diaphragm / of a dynamic speaker ] at the core of a magnetic gap which consists of a magnetic circuit.

#### [0002]

[Description of the Prior Art] There is a cone form loudspeaker which is one of the dynamic speakers. Drawing 10 is the outline sectional view of this cone form loudspeaker 51. The cone form loudspeaker 51 is equipped with the centering spider (common-name damper) 55 and frame 57 which hold the voice coil 53 connected [ diaphragm / 52 / the voice coil bobbin 50, the cone diaphragm 52, a voice coil 53, a magnetic circuit 54, and / cone ] at the core of a magnetic gap which consists of a magnetic circuit 54 in drawing 10. And this frame 57 supports the edge 56 connected [ periphery / of the cone diaphragm 52 ], a magnetic circuit 54, the centering spider 55, and an edge 56.

[0003] As the centering spider 55 of the dynamic speaker in an early time was shown in drawing 12 which is a sectional view in alignment with the top view of drawing 11, and D-D line of drawing 11, the butterfly damper form centering spider 58 which developed from the cantilever form was used.

[0004] To a resin sheet or textile fabrics, with the press machine, the butterfly damper form centering spider 58 carried out the sheet metal which sank in resin mold omission, and was manufacturing it. The butterfly damper form centering spider 58 had a fault, like there is possibility that iron powder will mix in a magnetic gap from the clearance between that it is hard to take the large amplitude and this butterfly damper form centering spider 58, although there was an advantage to which an effective mass becomes lightweight equivalent.

[0005] The corrugation form centering spider 59 may be used as the one approach of compensating the fault of the butterfly damper form centering spider 58 mentioned above. Drawing 13 is the top view of the corrugation form centering spider 59, and drawing 14 is the sectional view which met the E-E line of drawing 13.

[0006] As shown in drawing 13 and drawing 14, the corrugation form centering spider 59 serves as a configuration which sank into the textile fabrics which consist of cotton yarn, synthetic-resin yarn, etc., and carried out hot forming of the resin to them at two or more concentric circular waves.

[0007] Although there is an advantage which the large amplitude tends to take in comparison in the corrugation form centering spider 59, since an effective mass's becoming heavy equivalent compared with the butterfly damper form centering spider 58 and a configuration are the symmetry of revolution, that secondary resonance occurs in an about 10 times as many band as lowest resonance frequency  $f_0$ , and tends to make secondary distortion tone, and when air carries out outflow close [ of the clearance between the texture of textile fabrics ], there are faults, like a fricative occurs and distortion tone is made. These faults are remarkable in a loudspeaker with the light mass of vibration system at small aperture.

[0008] In the loudspeaker corresponding to digital signal playback in recent years, the advantage to which an effective mass becomes lightweight equivalent is taken, and there

is also an example using the butterfly damper form centering spider 60 of a configuration as shows the top view to drawing 15.

[0009] Generally, the configuration of opening of a loudspeaker is circular, and in order to carry out adhesion immobilization of the periphery of a centering spider at the frame of a loudspeaker, the corrugation form centering spider 59 and the butterfly damper form centering spider 60 as shown in drawing 13 and drawing 15 are used. In order to make lowest resonance frequency  $f_0$  into low frequency, the centering spider of the diameter of macrostomia is needed.

[0010] In recent years, on the display the television SHON set carrying a wide screen, and for personal computers, the loudspeaker of an ellipse or an ellipse form is used for the \*\* sake by even \*\* more often in the breadth dimension. Drawing 16 is the top view of the loudspeaker 61 of an ellipse or an ellipse form, and drawing 17 is the fragmentary sectional view of a loudspeaker 61. For a butterfly absorber form centering spider and 63, as for an edge and 65, in drawing 16 and drawing 17, a cone diaphragm and 64 are [ 62 / a frame and 66 ] magnetic circuits.

[0011] When the circular butterfly damper form centering spider 60 as shown in drawing 15 is used for the loudspeaker 61 of this ellipse or an ellipse form, the dimension of this centering spider 60 receives a limit in the dimension  $w$  of the minor axis of a loudspeaker 61. Therefore, since the butterfly damper form centering spider 60 cannot be done in the diameter of macrostomia, spoke partial 60a becomes short and it becomes difficult for stiffness to become high and to make lowest resonance frequency  $f_0$  low.

[0012] Then, the appearance of a butterfly damper form centering spider is doubled with the configuration of the frame of the loudspeaker of an ellipse and an ellipse form, four spoke partial 62a is lengthened using butterfly damper form pin center, large RINNGUSUPAIDA 62 of a configuration as shown in drawing 18, stiffness is made low, and lowest resonance frequency  $f_0$  is made low.

[0013]

[Problem(s) to be Solved by the Invention] However, in the butterfly damper form centering spiders 60 and 62 of a configuration as shown in drawing 15 and drawing 18, since the configuration which incurvated the spoke part two-dimensional is carried out, plate-like spoke partial 62a which curved in the butterfly damper form centering spider 62 when the loudspeaker carried out piston vibration is twisted, and piston vibration will be carried out, exercising by twisting loudspeaker vibration system by flexible sushi and this.

[0014] Therefore, when stress is received in the connection part of neck section 60b of spoke section 60a, i.e., ring section 60c and spoke section 60a, and a connection part with 60d of ring sections, and spoke section 60a and it drives with the large amplitude, it may damage. It may damage, when similarly stress is received in the connection part of neck section 62b of spoke section 62a, i.e., ring section 62c and spoke section 62a, and a connection part with 62d of ring sections, and spoke section 62a and it drives with the large amplitude.

[0015] Moreover, the inner circumference of the butterfly absorber form centering spiders 60 and 62 had the fault that an input will be restricted while the voice coil bobbin 50 produced deformation partially and generated distortion tone, when curved plate-like spoke section 60a or 62a expands and contracted since the cylinder-like voice coil bobbin 50 was pasted.

[0016] This invention is realizing the loudspeaker using the butterfly damper form centering spider and this which can impress the Dainyuu force to a loudspeaker while preventing breakage of the spoke part by twist telescopic motion of the spoke part accompanying piston vibration of a loudspeaker, holding that it is hard to produce that an effective mass is [ of a butterfly damper form centering spider ] small equivalent, and secondary resonance.

[0017]

[Means for Solving the Problem] This invention is constituted as follows, in order to attain the above-mentioned purpose. In the centering spider which holds the voice coil of a loudspeaker at the core of a magnetic gap The 1st almost circular ring section pasted up on the voice coil bobbin of a loudspeaker, The 2nd ring section which an appearance is size and is pasted up on the frame of a loudspeaker from the 1st ring section, It is the spoke of the pair which is arranged between the 1st ring section and the 2nd ring section, sees from [ of a loudspeaker ] vibration, and curves to hard flow mutually [ counter mutually and ], and has the spoke section which has at least three pairs of spokes of this pair.

[0018] Since the center section of the spoke expands and contracts as it extends when a loudspeaker carries out piston vibration in order, the spoke section does not produce twist vibration. Consequently, it is rare for stress to arise in the connection section of the ring section and the spoke section which are pasted up on a voice coil bobbin and a frame.

[0019] Moreover, the voice coil of a loudspeaker is set to the centering spider held at the core of a magnetic gap. The 1st almost circular ring section pasted up on the voice coil bobbin of a loudspeaker, The 2nd ring section which an appearance is size and is pasted up on the frame of a loudspeaker from the 1st ring section, It is the spoke of the pair which is arranged between the 1st ring section and the 2nd ring section, sees from [ of a loudspeaker ] vibration, and curves to hard flow mutually mutual almost in parallel, and has the spoke section which has at least three pairs of spokes of this pair.

[0020] Preferably, in the above-mentioned centering spider, from a connection part with the this spoke, 1st, and 2nd ring sections, each spoke which constitutes the spoke section has the configuration from which the cross section serves as smallness as it goes to the core of this spoke.

[0021] Since it has the configuration from which the cross section serves as smallness as it goes to the core of a spoke, it decreases that a twist's can improve and stress produces the flexibility of a spoke in the connection section of the ring section and the spoke section.

[0022] Moreover, in the above-mentioned centering spider, the 1st ring section, the 2nd ring section, and the spoke section are preferably formed by injection molding.

Moreover, in the above-mentioned centering spider, the cross-section configuration of a spoke is a rectangle, an ellipse form, or a round shape preferably.

[0023] Moreover, the voice coil of a loudspeaker is set to the centering spider held at the core of a magnetic gap. The 1st almost circular ring section pasted up on the voice coil bobbin of a loudspeaker, The 2nd ring section which an appearance is size and is pasted up on the frame of a loudspeaker from this 1st ring section, The 1st spider section which has the 1st spoke section which has at least three spokes which are arranged between the 1st ring section and the 2nd ring section, and curve in the oscillating direction of a loudspeaker, The 3rd almost circular ring section pasted up on the voice coil bobbin of a

loudspeaker, The 4th ring section which an appearance is size and is pasted up on the frame of a loudspeaker from this 3rd ring section, The 2nd spider section which has the 2nd spoke section which has at least three spokes which are arranged between the 3rd ring section and the 4th ring section, and curve in the oscillating direction of a loudspeaker, A preparation, the 1st spider section, and the 2nd spider section are pasted up so that the 1st spoke section and the 2nd spoke section may see from [ of a loudspeaker ] vibration and may curve to the reverse sense mutually.

[0024] Preferably, in the above-mentioned centering spider, each of the 1st spider section and the 2nd spider section carries out hot forming of the synthetic-resin plate, makes it a predetermined configuration mold omission, and is formed.

[0025] Moreover, preferably, in the above-mentioned centering spider, the 1st spider section and the 2nd spider section are pasted up so that the 1st spoke section and the 2nd spoke section may see from [ of a loudspeaker ] vibration and may counter mutually.

[0026] Moreover, preferably, in the above-mentioned centering spider, the 1st spider section and the 2nd spider section are pasted up so that the 1st spoke section and the 2nd spoke section may see from [ of a loudspeaker ] vibration and may become mutual almost parallel.

[0027] Moreover, it sets to the loudspeaker which consists of a voice coil, a voice coil bobbin, a cone diaphragm, a centering spider that holds a voice coil at the core of a magnetic gap, and a frame which supports these. The 1st almost circular ring section which pastes up a centering spider on a voice coil bobbin, The 2nd ring section which an appearance is size and is pasted up on a frame from the 1st ring section, It is the spoke of the pair which is arranged between the 1st ring section and the 2nd ring section, sees from [ of a loudspeaker ] vibration, and curves to hard flow mutually [ counter mutually and ], and has the spoke section which has at least three pairs of spokes of this pair.

[0028] Since the center section of the spoke expands and contracts as it extends when a loudspeaker carries out piston vibration in order, the spoke section does not produce twist vibration. Consequently, it can be rare for stress to arise in the connection section of the ring section and the spoke section which are pasted up on a voice coil bobbin and a frame, it can improve endurance, and impression of the Dainyuu force of it is attained at a loudspeaker.

[0029] Moreover, it sets to the loudspeaker which consists of a voice coil, a voice coil bobbin, a cone diaphragm and an edge, a centering spider that holds a voice coil at the core of a magnetic gap, and a frame which supports these. The 1st almost circular ring section which pastes up a centering spider on a voice coil bobbin, The 2nd ring section which an appearance is size and is pasted up on a frame from the 1st ring section, It is the spoke of the pair which is arranged between the 1st ring section and the 2nd ring section, sees from [ of a loudspeaker ] vibration, and curves to hard flow mutually mutual almost in parallel, and has the spoke section which has at least three pairs of spokes of this pair.

[0030] Moreover, it sets to the loudspeaker which consists of a voice coil, a voice coil bobbin, a cone diaphragm and an edge, a centering spider that holds a voice coil at the core of a magnetic gap, and a frame which supports these. The 1st almost circular ring section which pastes up a centering spider on a voice coil bobbin, The 2nd ring section which an appearance is size and is pasted up on a frame from this 1st ring section, The 1st spider section which has the 1st spoke section which has at least three spokes which are arranged between the 1st ring section and the 2nd ring section, and curve in the

oscillating direction of a loudspeaker, The 3rd almost circular ring section pasted up on a voice coil bobbin, and the 4th ring section which an appearance is size and is pasted up on a frame from this 3rd ring section, The spoke which is arranged between the 3rd ring section and the 4th ring section, and curves in the oscillating direction of a loudspeaker It had the 2nd spider section which has the 2nd spoke section which it has at least three, and the 1st spoke section and the 2nd spoke section have pasted up the 1st spider section and the 2nd spider section so that it may see from [ of a loudspeaker ] vibration and may curve to the reverse sense mutually.

[0031]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to an accompanying drawing. In order to simplify explanation, a circular butterfly damper form centering spider is explained as an example. Drawing 1 is the top view of the butterfly damper form centering spider 1 which is the 1st operation gestalt of this invention, and drawing 2 is the sectional view which met the A-A line of drawing 1 . In drawing 1 and drawing 2 , the butterfly absorber form centering spider 1 consists of 4 pairs of spoke sections 1a and the ring sections 1b and 1c pasted up on a voice coil bobbin and a frame. And the end part of each spoke section 1a is connected with ring section 1b, and a part for the other end is connected with ring section 1c.

[0032] 4 pairs of spoke sections 1a counters in the oscillating direction (cross direction of a loudspeaker) of a loudspeaker in which this centering spider 1 is attached mutually, curves, consists of spoke 1aa used as a pair, and 1ab, and is three-dimensional. Drawing 3 is the explanatory view of spoke section 1a of operation. In this drawing 3 , since the center section of spoke 1aa and 1ab expands and contracts as an arrow head shows, and it extends when piston vibration is carried out before and behind a loudspeaker, as a loudspeaker shows by the arrow head, spoke section 1a does not produce twist vibration as shown in the conventional example. Consequently, it is rare for stress to arise in 1d of connection sections with the ring sections 1b and 1c pasted up on a voice coil bobbin and a frame.

[0033] Therefore, while preventing breakage of the spoke part by twist telescopic motion of the spoke part accompanying piston vibration of a loudspeaker, holding that it is hard to produce that an effective mass is small and secondary resonance according to the operation gestalt of the above 1st, the loudspeaker using the butterfly damper form centering spider and this which can impress the Dainyuu force to a loudspeaker is realizable.

[0034] In addition, in the 1st operation gestalt of this invention mentioned above, although spoke section 1a was made into four pairs, it is possible to constitute the spoke section by not only four pairs but three pairs or more of two or more pairs.

[0035] Drawing 4 is the top view of the butterfly damper form centering spider 2 which is the 2nd operation gestalt of this invention, and drawing 5 is the sectional view which met the B-B line of drawing 4 . With the 1st operation gestalt shown in drawing 1 , spoke section 1aa and 1ab have composition which counters in the oscillating direction of a loudspeaker mutually. On the other hand, in the 2nd operation gestalt shown in drawing 4 and drawing 5 , these spoke section 2aa and 2ab(s) serve as the configuration where it was mutually parallel when seen from [ of a loudspeaker ] vibration, and the configuration which counters mutually has not become.

[0036] However, the point which consists of spoke section 2aa of the pair which spoke

section 2a consisted of four pairs, was formed between ring section 2a and 2b, and curved to the reverse sense mutually in the oscillating direction of a loudspeaker, and 2ab is the same as the 1st operation gestalt. Also in this 2nd operation gestalt, the same effectiveness as the operation gestalt of the above 1st can be acquired.

[0037] In addition, the 1st and 2nd operation gestalten mentioned above can be formed with injection molding, and as the quality of the material, for example, it is a single ingredient or the charges of an admixture, such as polyester resin and polypropylene resin, and they are good with the supple quality of the material.

[0038] As mentioned above, when forming the centering spiders 1 and 2 which are the 1st and 2nd operation gestalten with injection molding, the cross section of the spoke section can be adjusted according to a part.

[0039] As it follows, for example, the example of drawing 1 is shown in drawing 6, spoke section 1aa and 1ab thicken 1d of articulated sections with the ring sections 1b and 1c which are the parts pasted up on a voice coil bobbin and a frame as a cross-section size, and can become thin meat as cross-section smallness toward curved core 1ac.

[0040] Consequently, spoke section 1aa and 1ab can improve flexibility, and can decrease further 1d [ of articulated sections with the ring sections 1b and 1c pasted up on a voice coil bobbin and a frame ] stress. In addition, about the example of drawing 4, similarly, spoke section 2aa and 2ab thicken an articulated section with ring section 2b and 2c which are the part pasted up on a voice coil bobbin and a frame as a cross-section size, and can become thin meat as cross-section smallness toward the curved core.

[0041] Furthermore, in drawing 1 and the operation gestalt of drawing 4, when forming with injection molding, a rectangle, an ellipse form, and circular either are possible in the cross-section configuration of spoke section 1aa, 1ab, 2aa, and 2ab. In this case, the cross-section configuration of the spoke section is considered that it can raise the flexibility of the spoke section as it serves as an ellipse form and a round shape from a rectangle.

[0042] In drawing 1 and the operation gestalt of drawing 4, although the case where it formed with injection molding was explained, it is also possible to form the centering spider of this invention by approaches other than injection molding.

[0043] That is, drawing 7 is the decomposition perspective view of the butterfly damper form centering spider 3 which is the 3rd operation gestalt of this invention, is not injection molding in this 3rd operation gestalt, it sticks mutually the butterfly damper form centering spiders 3a and 3b of two sheets which carried out hot forming to the predetermined configuration and which carried out mold omission with the press machine on the reverse sense, and it forms them so that it may become the same configuration as the example of drawing 1.

[0044] That is, it connects between ring section 3ab, ring section 3ac, and these ring section 3ab and 3ac(s), and 1st centering spider section 3a is formed from four spoke section 3ad(s) which curve in the same direction (the oscillating direction of a loudspeaker). And like 1st centering spider section 3a, it connects between ring section 3bb, ring section 3bc, and these ring section 3bb and 3bc(s), and 2nd centering spider section 3b is formed from four spoke section 3bd(s) which curve in the same direction (the oscillating direction of a loudspeaker).

[0045] And 1st centering spider section 3a and 2nd centering spider section 3b paste up so that spoke section 3ad and 3bd may counter mutually and may serve as a configuration

which curves to the reverse sense mutually.

[0046] Also in the 3rd operation gestalt of this invention mentioned above, the same effectiveness as the 1st operation gestalt can be acquired.

[0047] In addition, in the example of drawing 7, it is also possible to paste up the centering spider sections 3a and 3b so that it may become a configuration like the example of drawing 4 instead of the configuration which spoke section 3ab and 3bd counter mutually.

[0048] Although the operation gestalt of this invention shown in drawing 7 from drawing 1 explained the example of the circular configuration applied to a circular loudspeaker as shown in drawing 10, in the loudspeaker of an ellipse as shown in drawing 16, and an ellipse form, it is good also as an ellipse and an ellipse form according to the frame configuration of a loudspeaker.

[0049] Drawing 8 is the top view of the butterfly damper form centering spider 4 which is the 4th operation gestalt of this invention, and drawing 9 is the sectional view which met the C-C line of drawing 8. In drawing 8 and drawing 9, the butterfly absorber form centering spider 4 consists of 4 pairs of spoke sections 4a, and ring section 4b pasted up on a voice coil bobbin and a frame and ring section 4c of an ellipse. And the end part of each spoke section 4a is connected with ring section 4b, and a part for the other end is connected with ring section 4c.

[0050] 4 pairs of spoke sections 4a counters in the oscillating direction of a loudspeaker mutually, curves, consists of spoke 4aa used as a pair, and 4ab, and is three-dimensional. This 4th operation gestalt becomes that other parts are the same as that of the 1st operation gestalt except for the point that ring section 4C pasted up on a frame serves as an ellipse.

[0051] Also in the 4th operation gestalt of this invention mentioned above, the same effectiveness as the 1st operation gestalt can be acquired.

[0052] In addition, since the spoke section of the butterfly damper form centering spider which is the operation gestalt of this invention mentioned above consists of the spoke sections which curved to the reverse sense mutually and became a pair, when secondary resonance occurs in each spoke section, it is negated mutually, suits and does not make distortion tone.

[0053]

[Effect of the Invention] Since this invention is constituted as explained above, it has the following effectiveness. Since it consists of the spoke section which curved in the oscillating direction of a loudspeaker and became a pair, respectively and the spoke section expands and contracts when a loudspeaker carries out piston vibration, the spoke section of the butterfly damper form centering section spider of this invention has that stress arises [ little ] in an articulated section with the ring section which vibrates by twisting a spoke and is pasted up on a voice coil bobbin and a frame. Consequently, it is effective in the ability to impress the Dainyuu force now.

[0054] Therefore, while preventing breakage of the spoke part by twist telescopic motion of the spoke part accompanying piston vibration of a loudspeaker, holding that it is hard to produce that an effective mass is [ of a butterfly damper form centering spider ] small equivalent, and secondary resonance, the loudspeaker using the butterfly damper form centering spider and this which can impress the Dainyuu force to a loudspeaker is realizable.

[0055] Furthermore, since stiffness can be adjusted by changing suitably the width of face and thickness of the degree of a curve of the spoke section, and the spoke section, the butterfly damper form centering spider of small aperture can be constituted comparatively. Consequently, it becomes possible to use for the loudspeaker of small aperture comparatively, and lowest resonance frequency  $f_0$  can be set up low.